WPAFB RADIATION SAFETY OFFICE

88 ABW/EMO

Wright-Patterson AFB, OH 45433-5332

IAEA Safety Standards Series Requirements ST-1 (1996)

http://www.abwem.wpafb.af.mil/em/emb/

Date: _____ **Shipper:** _____ **Destination:** _____

Item Description	Radionuclide	Activity Each	Number of Items	Total Activity

Radiation Package Survey Results: surface _____ **mrem/hr** **1 meter** _____**mrem/hr**

Instrument Used: Mfgr: _____ **Model:** _____ **S/N:** _____**Cal Date:** _____

Person Completing Checklist: _____ **Signature:** _____

PACKAGES and PACKAGING (General Requirements (§606-616))

YES NO

☐ ☐ 1. Designed in relation to its mass, volume and shape that it can be easily and safely handled and transported.
☐ ☐ 2. Designed so it can be properly secured in or on the conveyance during transport.
☐ ☐ 3. Design such than any lifting attachments on the package will not fail.
☐ ☐ 4. Packaging is such that the external surfaces are free from protruding features and can be easily decontaminated.
☐ ☐ 5. The outer layer of the package is so designed as to prevent the collection and retention of water.
☐ ☐ 6. Package capable of withstanding the effects encountered in transport.
☐ ☐ 7. Securing devices are designed to prevent them from becoming loose or being released unintentionally.
☐ ☐ 8. The smallest overall external dimension is not less than 10 cm (4 in). (§634)
☐ ☐ 9. The outside shall incorporate a security seal. (§635)
☐ ☐ 10. The non-fixed radioactive contamination on any external surface of the package shall not exceed 0.4 Bq/cm2 (10^{-5} µCi) beta-gamma and 0.04 Bq/cm^2 (10^{-6} µCi/cm^2) alpha. (§508).

CONTENT LIMITS FOR TYPE A PACKAGES

YES NO

☐ ☐ 1. Type A Package contains radioactive material(s) less than or equal to A_1/A_2 activity limits. (§413)

2. A_1/A_2 Activity Limit: _____TBq (_____mCi) Actual A_1/A_2 Activity: _____TBq (_____mCi)

If more than one radionuclide is being shipped in one package an unity calculation shall be performed.

Note: Selected radionuclide A_1/A_2 values are listed on the back. A complete listing can be found in Section IV, Table I

LABELING REQUIREMENTS FOR TYPE A PACKAGES

YES NO

☐ ☐ 1. Survey performed to determine proper label. (§533, Table VII)
- ☐ - Category I-White – Surface: ≤ 0.005 mSv/hr (0.5 mrem/hr) / T.I. None Required
- ☐ - Category II-Yellow – Surface: > 0.005 ; ≤ 0.5 mSv/hr (> 0.5 mrem/hr ; ≤ 50 mrem/hr) / T.I. ≥ 0 ; ≤ 1.0
- ☐ - Category III-Yellow – Surface: > 0.5 ; ≤ 2.0 mSv/hr (> 50.0 mrem/hr ; ≤ 200 mrem/hr) / T.I. ≥ 1 ; ≤ 10.0

☐ ☐ 3. Labels include Contents-Radionuclide(s); Activity-(Bq); T.I.-(Categories II-Yellow and III-Yellow ONLY). (§543)
☐ ☐ 2. Labels affixed to two opposite sides of the package. (§542)

MARKING REQUIREMENTS FOR TYPE A PACKAGES

YES NO

☐ ☐ 1. Outside of package marked with consignor, consignee or both. (§534)
☐ ☐ 2. Outside of package marked with appropriate UN# and Proper Shipping Name (i.e. UN2915, RADIOACTIVE MATERIAL, TYPE A PACKAGE). (§535)
☐ ☐ 3. Outside of package marked with gross mass, if package exceeds 50 kg (110 lbs.). (§536)

TRANSPORT DOCUMENT FOR TYPE A PACKAGES

YES NO

☐ ☐ 1. Proper shipping name (i.e. RADIOACTIVE MATERIAL, TYPE A PACKAGE). (§549(a))
☐ ☐ 2. United Nations Class Number "7". (§549(b))
☐ ☐ 3. United Nations Number – (i.e. UN2915). (§549(c))
☐ ☐ 4. Name or symbol of radionuclide(s). (§549(d))
☐ ☐ 5. Physical and chemical form of material. (§549(e))
☐ ☐ 6. Maximum activity for each radionuclide expressed in units of (Bq) with an appropriate (SI) prefix. (§549(f))
☐ ☐ 7. Category of package (I-White, II-Yellow, or III-Yellow). (§549(g))
☐ ☐ 8. Transport Index (Categories II-Yellow and III-Yellow ONLY). (§549(h))
☐ ☐ 9. Certification statement: *"I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked and labeled, and are in all aspects in proper condition for transport by (insert mode of travel) according to the applicable international and national governmental regulations."* (§550)
☐ ☐ 10. The document is signed and dated. (§552)
☐ ☐ 11. Supplementary information for loading, stowage, carriage, handling and unloading provided to the carrier. (§555)

TRANSPORTING BY ROAD

☐ ☐ 1. Labeled package, PLACARDS REQUIRED on two external lateral walls and the external rear wall of vehicle. (§570(b))
☐ ☐ 2. Non Exclusive Use radiation levels exterior surface of the vehicle $\leq$ 2 mSv/hr ($\leq$ 200 mrem/hr). (§572(a))

TYPE A QUANTITIES FOR SELECTED RADIONUCLIDES

(IAEA Safety Standards Series No. ST-1, Section IV, Table I)

Radionuclide	*A_1 (TBq)*	*A_2 (TBq)*	*Exempt Exempt Concentation (Bq/gm)*	*Exempt Activity (Bq)*
^{241}Am	10	0.001	1	10000
^{14}C	40	3	10000	1E7
^{57}Co	10	10	100	1E6
^{60}Co	0.4	0.4	10	1E5
^{137}Cs	2	0.6	10	10000
^{3}H	40	40	1E6	1E9
^{125}I	20	3	1000	1E6
^{85}Kr	10	10	1E5	10000
^{63}Ni	40	30	1E5	1E8
^{210}Po	40	0.02	10	10000
^{239}Pu	10	0.001	1	10000
^{226}Ra	0.2	0.003	10	10000
^{187}Re	Unlimited	Unlimited	10000	1E7
^{90}Sr	0.3	0.3	100	10000
^{232}Th	Unlimited	Unlimited	10	10000
Th (Nat)	Unlimited	Unlimited	1	1000
^{238}U	Unlmited	Unlimited	10	10000
U (depleted)	Unlimited	Unlimited	1	1000
U (Nat)	Unlimited	Unlimited	1	1000

DEFINITIONS

A_1 – the activity value of special form radioactive material.
E_c = Probe Efficiency (AP-100 = 0.3 for ^{239}Pu; BP-100 = 0.45 for ^{90}Sr)
A = Area Swiped (300 cm^2)
0.5 = 2 P to 4 P geometry conversion
$cpm_{(net)}$ = Background subtracted from gross count
1 Bq = 1 dps or 60 dpm

A_2 – the activity value of radioactive material, other than special form radioactive material.

CONSIGNEE – shall mean any person, organization or government which receives a consignment.

CONSIGNMENT – shall mean any package or packages, or load of radioactive material, presented by a consignor for transport.

CONSIGNOR – shall mean any person, organization or government which prepares a consignment for transport, and is named as consignor in the transport documents.

EXCLUSIVE USE – the sole use, by a single consignor, of a conveyance or of a large freight container, in respect of which all initial, intermediate and final loading and unloading is carried out in accordance with the directions of the consignor or consignee.

SPECIAL FORM RADIOACTIVE MATERIAL – shall mean either an indispersible solid radioactive material or a sealed capsule containing radioactive material.

TRANSPORT INDEX (T.I.) – assigned to a package, overpack or freight container or to unpackaged LSA-1 or SCO-I, shall mean a number which is used to provide control over radiation exposure. The T.I. is a dimensionless radiation measurement taken at one meter from the surface of a package and rounded to the nearest tenth.

Swipe Evaluation (ADM-300):

$$\frac{Bq}{cm^2} = \frac{cpm\ (net)}{0.5 \times E_c \times 60\ \frac{\text{sec}}{\text{min}} \times A(cm^2)}$$

E_c = Probe Efficiency (AP-100 = 0.3 for ^{239}Pu; BP-100 = 0.45 for ^{90}Sr)
A = Area Swiped (300 cm^2)
0.5 = 2 P to 4 P geometry conversion
$cpm_{(net)}$ = Background subtracted from gross count
1 Bq = 1 dps or 60 dpm

$$\frac{Bq}{cm^2} = \frac{100\ cpm}{0.5 \text{ x } 0.3 \text{ x } 60\ \frac{\text{sec}}{\text{min}} \text{ x } 300\ cm^2} = \frac{100}{2700} = 0.037\ \frac{Bq}{cm^2}$$

$$0.037\ \frac{Bq}{cm^2} \times 60\ \frac{dpm}{Bq} = 2.22\ \frac{dpm}{cm^2}$$